PROUDMAN OCEANOGRAPHIC LABORATORY

CRUISE REPORT NO. 40

Inverted Echo Sounders in the Denmark Strait

As part of

FS POSEIDON 290

JUNE 6, 2002 – JUNE 24, 2002

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ABSTRACT

The overflow of cold dense water from the Denmark Strait is one of the key elements of the north Atlantic thermohaline circulation and has important consequences for global climate change. It is important to measure the transport of this water and to understand its variability on seasonal and at longer time scales.

The European funded project "Variability of Exchanges in Northern Seas" (VEINS MAS3CT960070) was an attempt to measure variations in the Arctic circulation using modern oceanographic instrumentation. The current program is a continuation of this research and may contribute to a proposed new program, Arctic Sub-Arctic Ocean Fluxes (ASOF).

A combined Inverted Echo Sounder and Bottom Pressure Recorder was successfully recovered and re-deployed in the Denmark Strait to measure the thickness of this cold dense water and thus determine transport.

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CRUISE PERSONNEL

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OVERVIEW

The overflow of cold dense water from the Denmark Strait is one of the key elements of the north Atlantic thermohaline circulation and has important consequences for global climate change. It is important to measure the transport of this water and to understand its variability on seasonal and at longer time scales.

VEINS (Variability of Exchanges in the Northern Seas) was an EU-MAST project aimed at measuring the variability of ocean fluxes between the Arctic and the North Atlantic for a period of three years. Long-term measurements were made using modern oceanographic instrumentation to determine the variation of the Arctic circulation. Part of this work involves the Denmark Strait where an array of current meters is in place to measure the strength of the Overflow Water (DSOW). CTD surveys provide knowledge of the physical properties.

To measure its thickness, and hence get a value for transport for the DSOW, an Inverted Echo Sounder was deployed in the core of the current with a view to detecting the echo from the interface between the cold bottom water and the overlying intermediate layer.

The current work program, funded by organisations in the United States of America, is a continuation of the work done during the VEINS project. The data collected may eventually

contribute to a proposed new program Arctic Sub-Arctic Ocean Fluxes (ASOF) which is a collaboration between several European countries, the United States and Canada.

POL CRUISE OBJECTIVES

1) To recover one Inverted Echo Sounder in the Denmark Strait.
2) To re-deploy one Inverted Echo Sounder in the Denmark Strait.

IES/BPR DEPLOYMENTS

Ship Preparation

POL personnel joined FS Poseidon at St Johns, Newfoundland on June 6, 2002. The equipment was loaded aboard the ship, unpacked and stowed safely.

RECOVERY OF IES/BPR (UK1/IES) 13/6/2002

EVENTS

13.52 GMT	Vessel on station.
13.53 GMT	Release command transmitted.
14.10 GMT	Released from the seabed.
14.47 GMT	On the surface.

Total time on station: 55 minutes

IES/BPR (UK1/IES) Recovery Summary

Acoustic conditions were very good since the ship shut down the echo sounder and the propellers as soon as it was on station. Communication with both acoustic releases was definite and immediate. The release signal was transmitted to both burnwire release systems and the ship drifted whilst range readings were made to monitor for the moment of release. During ranging, it was clear that the burnwire releases had activated since for every single acoustic ping from the ship, five replies were received. The first reply indicated the range whilst the following four pings verified release activation. Release from the ballast weight was clearly indicated from the slant range reading on the deck unit.

DEPLOYMENT OF IES/BPR (UK1/IES) 15/6/2002

EVENTS

15.57 GMT	Vessel on station.
15.59 GMT	Release into the water.
16.37 GMT	On the seabed.

Total time on station: 40 minutes.

IES/BPR (UK1/IES) Deployment Information

The ship was acoustically very quiet, so it was possible to achieve excellent communication with both acoustic releases to the seabed.

CONCLUSIONS

All of POL cruise objectives were achieved.

APPENDIX 1 - BPR TECHNICAL INFORMATION

IES/BPR (UK1/IES) RECOVERY INFORMATION

Location details	**-**	***Latitude 63°28.69' N***
		Longitude 036°18.81' W
		Depth 1991m
On station	-	13.52 GMT on 13/6/2002
Release command transmitted	-	13.53 GMT
Released from seabed	-	14.10 GMT
On surface	-	14.47 GMT

Acoustics fitted were 46457 (Rx 15.0 kHz, Tx 12.0 kHz, Release B) and 46428 (Rx 14.5 kHz, Tx 12.0 kHz, Release D). The release command was transmitted to both Burnwires. Both acoustic units had activated the release and this was indicated by five pings from the acoustic release every time a range reading was taken. Indication of release from the frame was clearly detected by the decreasing slant range readings on the deck unit.

Logger
Timebase

Expected Scan	Actual Scan
10.00.00 GMT on 14/6/2002	09.58.36 GMT on 14/6/2002

Timebase is 84 seconds fast.

Data were downloaded to uk1bpr0102.raw

Data Arrangement
The raw data are made up of six columns

Column	**Data**
1	Scan Time
2	Date
3	Temperature (DQ 36573)
4	Pressure
5	Temperature (DQ 38175)
6	Pressure
7	Blank
8	Blank

Inverted Echo Sounder

IES pinged at 11.07.36 GMT on 14/6/2002.
The data were downloaded to uk1ies0102.v12

Number of data files stored to disk was 4163. The IES was fitted with a Hitachi 1.4Gb disk drive and stored one sample per datafile. Sampling interval was 120 minutes and the sample length was 5409 milliseconds.

Old Batteries

Acoustic release 46457	-	Orange	12.54V
		Red	12.56V
Acoustic release 46428	-	Orange	12.35V
		Red	12.435V
Burnwire 46457	-	26.6V	
Burnwire 46428	-	26.5V	
IES logger battery (pack 1)	-	Orange	12.61V
	-	Red	12.56V
IES logger battery (pack 2)	-	Orange	12.17V
	-	Red	12.16V
IES logger battery (pack 3)	-	Orange	12.47V
	-	Red	12.48V
IES transponder battery (pack 4)	-	Orange	12.13V
	-	Red	12.13V

Servicing Information

The frame is of the MkIV variety and is in good condition with little sign of corrosion. The BPR logger tube was in good condition, if slightly dirty looking. The EPROM card was removed for data retrieval and the EPROMs then erased. Both stainless steel clamps of the Inverted Echo Sounder were corroded and these were replaced by a single new clamp. The condition of the glass sphere is giving cause for concern. There are thin fragments of glass breaking off from near to the sealing face on the inside of the sphere. It should survive for another deployment but must be replaced next year.

IES/BPR (UK1/IES) DEPLOYMENT INFORMATION

Location details	**-**	***Latitude 63°28.58' N***
		Longitude 036°17.37' W
		Depth 1991m
On station	-	15.57 GMT on 15/6/2002
Released into the water	-	15.58 GMT
On seabed	-	16.37 GMT

Acoustic Information

Benthos XT6000 46428	-	Rx 14.5 kHz, Tx 12.0 kHz, Release D
Benthos XT6000 46457	-	Rx 15.0 kHz, Tx 12.0 kHz, Release B

Both of the acoustic units are using a burnwire release mechanism.

Logger

Logger SSDL 5 with sensors DQ 36573 and DQ 38175
Timebase started 11.00.00 GMT on 14/6/2002
First scan at 11.15.00 GMT on 14/6/2002

Inverted Echo Sounder

IES fitted with POL ADC board and Hitachi 1.4GB disk drive.
IES started at 09.59.40 GMT on 15/6/2002.
First chirp at 11.59.59 GMT on 15/6/2002.

Set-up parameters

Chirp interval	-	120 minutes
Sample rate	-	fast
Samples per datafile	-	1
Lockout (1/100s)	-	0
Start file number	-	1
Serial number	-	5
Deployment number	-	8
Comment	-	UK1/IES0203 Denmark Strait

Recovery Equipment

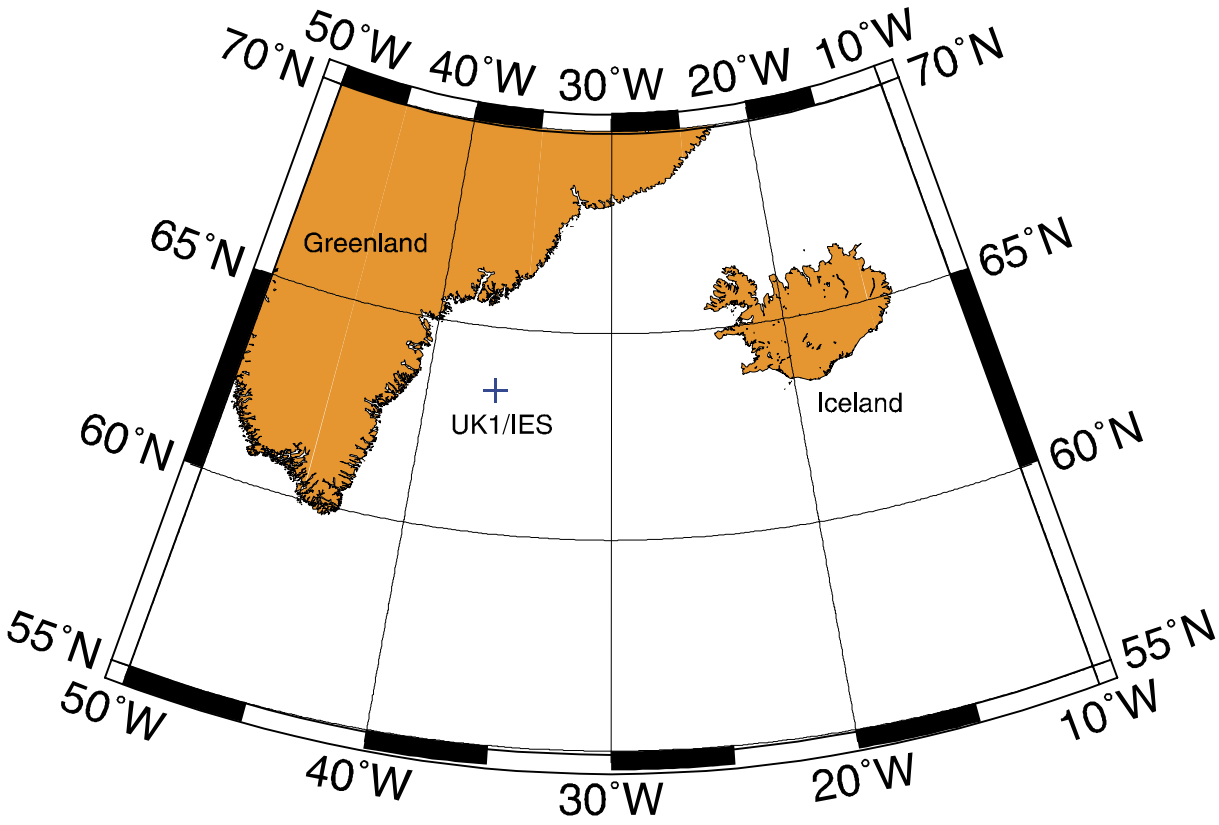
Benthos Radio Beacon	-	154.585 MHz, Channel A

New Battery Information

Acoustic release 46457	-	Orange 14.51V
		Red 14.51V
Acoustic release 46428	-	Orange 14.18V
		Red 14.19V
Burnwire 46457	-	28.6V
Burnwire 46428	-	28.6V

IES logger battery (pack 1)	-	Orange	14.11V
	-	Red	14.18V
IES logger battery (pack 2)	-	Orange	14.17V
	-	Red	14.18V
IES logger battery (pack 3)	-	Orange	14.15V
	-	Red	14.17V
IES transponder battery (pack 4)	-	Orange	14.18V
	-	Red	14.18V

MAP OF IES/BPR DEPLOYMENT POSITION



GLOSSARY

ADC	-	Analogue to Digital Converter
ASOF	-	Artic Sub-Arctic Ocean Fluxes
BPR	-	Bottom Pressure Recorder
CEFAS	-	Centre for the Environment, Fisheries and Aquaculture Science
CTD	-	Conductivity, Temperature and Depth Profiler
DSOW	-	Denmark Strait Overflow Water
EPROM	-	Erasable Programmable Memory
GMT	-	Greenwich Mean Time
IES	-	Inverted Echo Sounder
IfMH	-	Institut für Meereskunde, Hamburg University
POL	-	Proudman Oceanographic Laboratory
VEINS	-	Variability of Exchanges in Northern Seas